Poisonous Snakebite Worldwide

- Est 1 million people bitten / yr
- 25,000 - 50,000 deaths / yr

Snakebite in the US
(1950’s statistics)

- 45,000 bites / yr
- 8000 bites / yr by venomous snakes
- 12-15 deaths
  - (1997) 5-6 deaths
- 99% pit vipers (rattlesnakes, copperhead, water moccasin), 1% coral snakes
- Most deaths probably from direct IV envenomation

Snakebite in the US
(Gold, B, NEJM, 8/2002)

- Most victims male, 17-27 yo
- 98% on extremities
- Most between April - Sept
- Majority in SW US
- Fewer from agricultural activities
  - Increased from exposure to captive snakes
- EtOH often a factor
- Most deaths from eastern and western diamondback rattlesnakes

Snake Family Chart

Snake (Sub)Families

- Colubridae-- 2/3’s of snakes
  - Most nonpoisonous, except African boomslang, etc
- Viperinae-- ‘True’ vipers, Old World only
  - Vipers, adders
- Crotalinae-- ‘Pit’ vipers, New World, Asia
  - Rattlesnakes, massasauga, cottonmouth water moccasin, copperhead, fer-de-lance
- Elapinae (poisonous)
  - Cobras, mambas, kraits, taipans, coral snakes (only Elapinae in US-south)
- Hydrophiinae-- seas snakes (poisonous)
- Pythoninae-- pythons (nonpoisonous)
• Boinae-- boas (nonpoisonous)

US Venomous Snakes
• Crotalinae (Pit Vipers)-- Rattlesnakes, Cottonmouth, Copperhead
• Elapinae-- Coral Snake

Rattlesnakes
• Crotalus species (larger), Sistrurus (smaller)
• Eastern Diamondback- largest
  • Diamond markings on back- dark brown/black with tan/yellow borders
  • 5’ length
  • Pine woods, thickets, swamps
  • SE US
• Western Diamondback
• Timber rattlesnake
  • Eastern US and add’l wide distribution
  • Hills, mountains, ledges, woods
  • Lake George-- Tongue Mt
• Massasuga and Pigmy rattlers
  • 2’ length
  • Pine woods, thickets, around lakes/swamps
  • Less toxic
• Others:
  • Sidewinders (SW deserts)
  • Mojave rattlesnake (SW deserts)
    • Most potent neurotoxin of rattlesnakes

Moccasins (Agkistrodon)
• Cottonmouth (A. piscivorus)
  • Dark olive green - black
  • Pale white oral mucosa
  • Aquatic (‘water moccasin’)
  • 3’ length
  • Southern US
• Copperhead (A. contortrix)
  • Hourglass and inverted-Y configurations
  • Copper-brown head
• 2-3’ length
• Ubiquitous locations

Coral Snake
• Broad rings of red, yellow and black
  • Similar non-poisonous snakes
• 15-28”
• S and SW US
• Shy, nocturnal, rarely bites humans
• Neurotoxic venom

Poisonous US snakes
• None in Hawaii, Alaska, Maine
• None on Caribbean Islands (though sea snakes)
• 30-75% of bites have no envenomation
  • 25% no envenomation (Gold, NEJM, 8/2002)

Native Venomous NY Snakes:
(SUNY-ESF & ADK)
• Timber Rattlesnake
  • ‘Threatened’ in NYS
  • SE NY up to Lake George (Tongue Mt)
• Massasauga (erroneously called ‘pygmy rattler’)
  • ‘Endangered’ in NYS
  • Wetlands NE of Syracuse and west of Rochester
• Copperhead
• (Captive exotic snakes)

Pit Vipers (venomous) vs
Colubridae (nonvenomous)
• Anterior fangs (may fold back at rest)
• Triangular-shaped heads
• Elliptical pupils
• Heat-sensing ‘pit’ between eye and nostril
• Single row of subcaudal scales (vs double row)
• Rattle (for rattlesnakes)

Snake bite wound
• Non-poisonous: four rows of small scratches (4 rows of teeth in upper jaw), separated from two rows of small scratches (2 rows in lower jaw)
• Poisonous: fang puncture(s) +/- add’l teeth marks
  • Pain in 90% within 5 mins - 1 H

US Snake Toxicity
• Rattlesnakes >
• Cottonmouth >
• Copperhead

Venom
• Complex mixture-- many enzymes and peptides with multiple effects:
  • Local tissue necrosis, proteases, phospholipase A2
  • cause pain, tissue injury
  • Coagulation effects (DIC, fibrinolysis), and vascular integrity
  • Neurotoxic-- paralysis, but fully reversible
  • often do NOT cause local pain or swelling
  • Other systemic effects (cardiac, renal, muscle, etc)

Snake Venoms-- Local Effects
• Pain
• Swelling, tissue hemorrhage
  • May be massive with loss of several liters of blood
• Bullae
• May progress to necrosis

Snake Venoms-- Systemic
• Coagulation: DIC, fibrinolysis
• RBC toxic
• Vascular integrity
• Other: cardiac, renal muscle, etc

Snake Venoms-- Neurotoxic
• Block synaptic transmission, or excess transmission (Mamba- >tetany)
• Vomiting, HA, paresthesias, apathy, drowsiness
• Diplopia, ptosis, ophthalmoplegia
- Dysarthria, glosopharyngeal paralysis
- Respiratory paralysis
- Completely reversible

### Venom
- Varies among different snake families, species, geographical areas
- Usually mixture of toxins / effects
- Vipers-- DIC
- Pit vipers (rattlesnakes)-- local necrosis, hematologic
  - Mojave rattlesnakes-- also neurotoxic
- Elapidae (coral snake in US)-- neurotoxic (may have no local effect), Cobras-- paralysis and local necrosis
- Sea snake-- myotoxic, renal failure

### First Aid
- ABC’s
- Immobilize limb
  - At / below heart level
  - Remove rings, watches, etc
- Transport to medical facility
- Snakebite NOT usually fatal in first mins-2H
  - Generally, several hours for severe toxic effects to develop

### First Aid Cont.
- Identify snake if possible, but
- Avoid further injury
- **Do not handle dead snake head**
  - May still bite by reflex

### First Aid- Tourniquets (prob No)
- Generally NOT
  - More complications from the tourniquet than the bite
  - Maybe, if applied by medical personnel
- +/- Lymphatic tourniquet if viper / rattlesnake
  - 5-10 cm proximal to bite, loose
- Arterial tourniquet/wrap if neurotoxic snake and 1/2 - 2 H until medical Rx
- Care with tourniquet removal (usually after antivenom)

### First Aid- Incision etc (prob No)
- Suction syringe kit (vacuum extractor pump device)
- Apply within 5 mins
- Continue for > 30 mins

vs
- Incision and suction controversial---> increased infection
- Linear (not cruciate) 1/4” incisions

Envenomation- local findings
(pit viper)
- Generally begin within 30-60 mins
  - Pain (90%) usually immediate
  - Edema: 30 mins - sev hours
  - Bullae: sev hours
  - Lymphangitis
  - Ecchymosis at/around bite: 3 - 6 hours
- Circumferential measurements Q 20 mins

Envenomation- systemic findings
(pit viper)
- Distinguish ‘terror’ response from envenomation
- N/V, perioral paresthesia, tingling of fingers/toes, myokymia, lethargy and weakness
- Some rattlesnakes- ‘rubbery’, ‘minty’ or ‘metallic’ taste
- More severe: hypotension, tachypnea, dyspnea, tachycardia, altered sensorium
- Coagulopathy, DIC
- Capillary leak, hemolysis, renal failure, etc

Coral Snake Envenomation
- Little or no pain
- Neurotoxin
- Tremors, marked salivation, mental status changes (drowsiness or euphoria)
- Ptosis, dysarthria, dysphagia, dyspnea, respiratory paralysis

Hospital
- ABC’s
- Serial exams-- envenomation grade, neuro
- IV Antivenom depending on signs/symptoms
- Care in removing tourniquets
- Serial labs-- CBC, PT, PTT, fibrinogen, BUN/creat, CPK, U/A, EKG
- If antivenom given-- monitor in ICU
  - Some pretreat with epi, H1&2-blockers, steroids

Hospital cont.
- Tetanus toxoid prn
- +/- AB’s
  - Wound infections rare after pit viper bites
- +/- Elevate/level (per SESAP)
- Wound debridement as needed (sometimes excision of bite site if anatomically expedient, within 30 mins - 2H)

Hospital cont.
- Fasciotomy-- different recommendations
  - May first attempt elevation and add’l 4-6 vials of FabAV over 1H
  - Fasciotomy if measured compartment syndrome
  - Fingers-- clinical judgement

Hospital cont.
- No steroids (except for serum sickness from antivenom)
- No cryotherapy
- No electrotherapy

Hospital cont.
- For US snakes, usually OK if
  - no local symptoms > 8-10 H,
  - no neurotoxic symptoms > 12-24 H

Envenomation Grades
- Envenomation grade determines need for antivenom in pit viper bites:
  - Minimal: local pain, edema, no systemic toxicity, NL labs
  - Moderate: severe local pain, edema > 6-12”, systemic toxicity (N/V), abnormal labs (Hct, plts, etc)
  - Severe: generalized petechiae, ecchymosis, blood-tinged sputum, hypotension, shock, renal dysfunction, coag abnormalities
• Symptoms may progress over hours (or longer)

**Antivenom Rx**
• Minimal envenomation-- generally No antivenom
  • ( except maybe rattlesnakes)
• Moderate-- YES
• Severe-- YES
• Ideally, within 6H of bite
• Antivenin for all coral snake bites if within 12 H
  • (neurotoxicity may develop without warning)

**US Snake Antivenom**
• Neutralizing Ab
• Old (1956) Wyeth Crotalidae Polyvalent Antivenin
  • polyvalent, from horses
  • ? no longer available
• New (2000) Savage CroFab
  • monovalent ovine (sheep) Fab fragments (immunogenic Fc portion removed)
    • Like digoxin-binding antidote
    • More potent (5x’s), fewer rx’s than previous
    • Effect may wane-- monitor pt, redose

**US Snake Antivenom**
• Coral Snakes: Wyeth Micrurus Antivenin
  • ? no longer available

**Crotalidae Polyvalent Immune Fab (Crofab)**
• Mild-mod envenomation: 4-6 vials IV over 1H
  • Reconstitute with 10 mL saline, then dilute in 250 mL NS
  • Begin infusion slowly (25-50 mL/H) for 10 min
  • If no allergic rx, complete over 1H
  • Repeat prn for control of sympts
    • Total 8-12+ vials may be needed

**Crotalidae Polyvalent Immune Fab (Crofab)**
• Maintenance: 2 vials IV Q 6 H for 18 H (3 doses)
  • or sympts may recur
  • Additional prn
• Pediatric-- same antivenom doses
  • To neutralize envenomation;
Minimal Envenomation

- Antivenom controversial for min envom
  - New ovine Fab maybe used more liberally if less risk
- Rattlesnakes: YES
- Cottenmouth: Maybe
- Copperhead: NO
- Coral Snake: Different antivenom
  - YES, since minimal local effects

Antivenom- Adverse Rxs

- 20-50% (14% for CroFab) Immediate allergic rx (1/2 cutaneous, 1/2 systemic)-- stop infusion, airway, epinephrine, Benadryl
  - Anaphylaxis- Type I Mast cell Histamine release- variable symptoms
  - If severe envenomation, may resume antivenom with Epi/Benadryl/close monitoring
- >50% (16% for CroFab) serum sickness
  - Type 3, Ab-horseAg complexes-- malaise, fever, chills, arthralgia, rash at 1-3 wks
  - Responds to tapering course of oral prednisone (begin 60 mg/ day)

Antivenom Rx Overview

- Minimal envenomation (limited local effects, no systemic)-- No antivenom
  - Maybe Yes for rattlesnakes, young pts
- Moderate (more extensive local effects, limited systemic)-- Yes
- Severe-- Yes
- Coral snakes-- Yes if within 12 H

Exotic Snakes

- Use antivenom specific for snake / geographical area
  - Zoos may carry antivenom for exotic snakes

Additional info/help

- Regional poison-control center
  - National hotline # 800-222-1222

References
Micromedex- Crofab
SUNY College of Environmental Science and Forestry. Snakes of NY. www.esf.edu

End